mitted from the North of China by M. de Montigny, M. Fontanier, and M. l'Abbé Armand David, especially those of the last-named traveller, who devoted several years to zoological researches in the country north of Pekin, and in the distant parts of Mongolia. The series of Mammals here treated of is of especial interest as supplementing the discoveries recently made by Russian naturalists in Central and Eastern Siberia. The forms are chiefly those characteristic of the steppe-regions of the great northern continent of the Old World, such as *Siphneus*, *Cricetus*, *Dipus*, and *Spermophilus*. A full account is also given of the deer of this district, as also of the larger and smaller cats. Amongst the latter are enumerated the Ounce (*Felis irbis*), of which examples were obtained by M. Fontanier, and two species described and figured as new, under the names *Felis microtis* and *F. tristis*. Lastly, M. Milne-Edwards records the existence in the mountains situated in the east of the province of Tché-li (as testified by M. Fontanier) of a singular species of ape of the genus *Macacus*, which he designates *M. tcheliensis*. Considering that the province of Tché-li is nearly on the same isothermal line as Paris, the discovery of this animal is not a little remarkable.

The concluding essay of the volume relates to a still more novel mammal fauna than that of Pekin. Among the Yung-Ling Mountains, in the far interior of China, lies the little-known principality of Moupin, which we have already alluded to. Here the Abbé David, after a stay of several years in Northern China, established himself for a year in one of the large valleys at an elevation of about 6,000 feet above the sea-level, and in the midst of peaks ranging up to above 15,000 feet of altitude. Of the wonderful discoveries which he here made we have already learnt something from the preliminary notices of M. Alphonse Milne-Edwards on this subject. In the present memoir, detailed accounts are given of the many strange forms of which specimens were obtained by M. David in this district. Excellent illustrations, not only of the entire animal, but also of its characteristic parts, add greatly to the value of the descriptions, and we now become acquainted for the first time with the singular appearance of *Rhinopithecus roxellanæ*, a long-haired monkey with a "tip-tilted" nose, which inhabits the mountain-forests of Moupin; with *Nectogale elegans*, a new aquatic Insectivore of the same district; with *Scaptonyx*, a new genus of the Mole family, from the confines of Setchuen; and with *Ailuropus melanoleucus*, from the inaccessible mountains of Eastern Thibet.

The last-named animal, which in external appearance presents some resemblance to a large white bear with a black band across the back, is most nearly allied to the Panda (*Ælurus*) of the Himalayas, and belongs to the same peculiar family of Carnivores. Besides these, we have an account of *Elaphodus*, a new genus of ruminants, belonging to the Deer family, but with very diminutive horns; and of many other new and interesting Mammals, which show that the fauna of this part of Thibet is in many respects akin to that of the southern slope of the Himalayas. On the whole, we think there can be no question that the present work is one of the most important contributions that has lately been made to zoological science, and reflects the greatest credit upon its accomplished authors.

OUR BOOK SHELF

An Introduction to Human Anatomy. By William Turner, M.D. (Edinburgh: Adam and Charles Black, 1875.)

PROF. TURNER having written the article "Anatomy" in the first volume, recently published, of the ninth edition of the "Encyclopædia Britannica," has, at the suggestion of the publishers, reproduced it in a separate form, the first half of which we have received as a compact volume of some 400 pages.

This part contains an account of the skeleton, joints, muscles, nervous system, and organs of special sense, together with a chapter on the minute anatomy of the different tissues of the human body. The descriptions are short and make no pretensions to extreme minuteness, as may be judged from the following reference to the atlas:—"The first (vertebra) or *atlas*, has no body or spine: its ring is very large, and on each side of the ring is a thick mass of bone, the *lateral mass*, by which it articulates with the occipital bone above and the second vertebra below." In the account of the muscles also the space devoted to each is frequently little more than that required for the mention of the name:—"The supinator and pronator muscles (of the fore-arm) are all inserted into the radius; the supinators are the supinator longus, supinator brevis, and the biceps; the pronators are the pronator teres and the pronator quadratus." The nervous system has received more attention, and the general description of the brain, together with that of its more intimate structure, is fairly full. The author's valuable observations on the cerebral convolutions, together with his investigations on the relation of these to the walls of the bony cranium and the sutures, receive their due share of notice, and are here collected together for the first time. The chapter on the organs of special sense are also well worthy of study. In the histology we cannot help thinking that almost too much credit is given to a young and promising microscopist, some of whose results are still, however, decidedly *sub judice*.

We find it difficult to decide mentally to what class of students the work before us will be of most value. To the ordinary medical student who has but a couple of years in which to fully master the subject of human anatomy, the detail will not be sufficient, and one of the text-books will be more useful. To the amateur reader there is a mass of technical terms which he will have to attempt to wade through, almost certainly without success, both on account of their number and, to him, their meaninglessness. To the special investigator of the anatomy of the nervous centres the chapter devoted to that subject will be extremely valuable, as the whole work will be to the advanced student who desires to take a rapid last glance through his subject before competing for a high examination place.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

On the "Law of Fatigue" regulating Muscular Exertion

IN NATURE, vol. xi. pp. 256 and 276, Mr. Frank E. Nipher, of the University of Iowa, has published some interesting observations bearing on the "Law of Fatigue" which regulates muscular exertion, and criticises the use which I have made of some experiments published by him, one series of which seemed to me to be highly confirmatory of the "Law of Fatigue" which I had previously established on the basis of other experiments carefully made, and quite different in principle.

The "Law of Fatigue" is thus stated by me in "Principles of Animal Mechanics," p. 442:—"Law III. When the same muscle (or group of muscles) is kept *in constant action* until fatigue sets

in, *the total work done* multiplied by the *rate of work* is constant." The words *constant action* are here to be understood in the sense in which all muscular action used by animals is constant, viz., short periods of contraction followed by short intervals of rest, as in walking, climbing, &c. And the velocities employed are understood to be, within certain limits, such as are used in all descriptions of labour.

The "Law of Fatigue" (thus stated) is based by me upon several and various classes of experiments.

Mr. Nipher's experiments (employed in my book, pp. 462–65) consisted in raising various weights at a fixed rate and at regular intervals through a fixed height, as described in page 462 of my book. The "Law of Fatigue" in this case led me to the formula—

$$n\,(w + \alpha)^2 = A \qquad (1)$$

which is a cubical hyperbola.

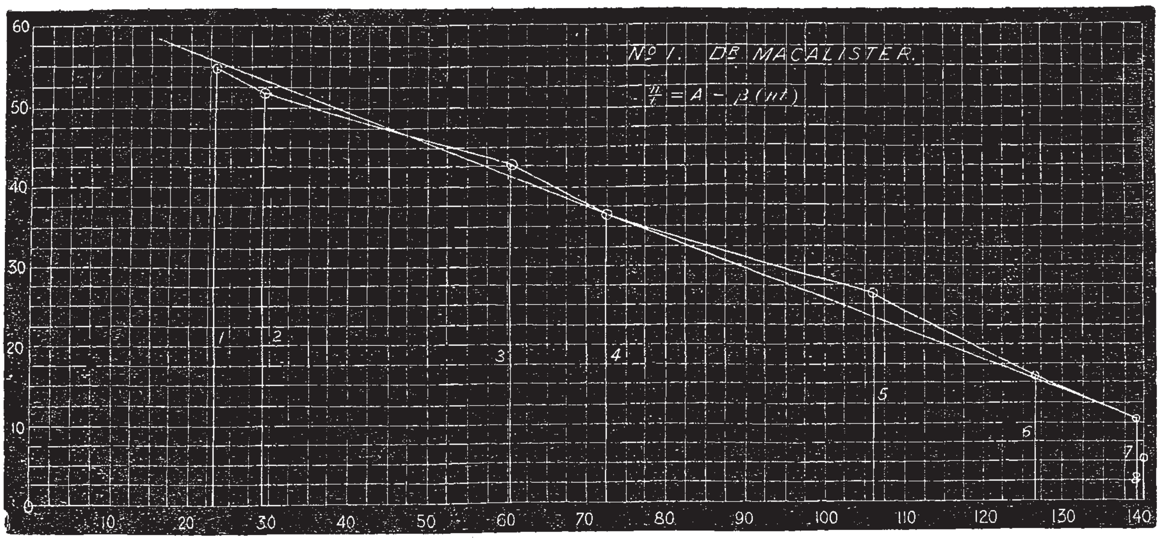
As stated in NATURE by Mr. Nipher, the comparison of this formula with observation is given in pp. 464–65, and is most complete and satisfactory. I here give it for the right arm, and refer for that of the left arm (which is equally satisfactory) to the book itself.

Mr. Nipher—Right Arm (raising weights at constant rate).

w	n (obs.)	n (calc.) from (1)	Diff.	Diff. per cent.
1 kil.	255	250	+ 5·0	+ 1·9
2 "	97	111	− 14·0	− 14·5
3 "	61	62·5	− 1·5	− 2·4
4 "	37·7	39·9	− 2·2	− 5·8
5 "	29·3	27·8	+ 1·5	+ 5·1
6 "	21·5	20·4	+ 1·1	+ 5·1
7 "	15·8	15·6	+ 0·2	+ 1·2
8 "	12·8	12·4	+ 0·4	+ 3·1

$A = 1{,}000$ *
$\alpha = 1$

Mr. Nipher admits (NATURE, vol. xi. p. 257) that this comparison of his observations with formula (1) deduced from the "Law of Fatigue" is satisfactory, but proposes (NATURE, vol. xi. p. 276) to substitute for his observations used by me, another set of similar observations submitted to a series of reductions;



these observations are given in his Table II., and will be fully considered by me hereafter. I may here observe that the percentage error in the above table is less than that given by him in comparing Table II. with an empirical formula.

Other experiments, in which the same weight was lifted at varying rates, were made by Dr. Alexander Macalister, Mr. Gilbert Haughton, and by Mr. Nipher (*vide* "Animal Mechanics," pp. 468 to 477). Mr. Nipher now rejects his own experiments, and, as I believe, with good reason. These experiments are given in NATURE, vol. xi. p. 256, Table I., with the exception of the first line, which is taken from the experiments just given. The reason why I transferred the first experiment from the former series is this. The column for n ought to show a maximum in passing from very rapid to very slow motions; for if the motions be very rapid, respiratory distress sets in, and the work done will be less than with a slower motion; and if the motion be very slow, the useful work done will be also less, owing to the fatigue work spent in holding up the weight; from this it follows that there is a certain rate of lift at which the maximum work is done.

If we omit the first line in Mr. Nipher's experiments, Table I., we find no trace of a maximum in the column for n, which may be regarded as internal evidence of something wrong in the observations. At the time of publishing my book, I thought (and still think) that Dr. Macalister's and Mr. Gilbert Haughton's experiments were better than those of Mr. Nipher, of which, however, I made use as well as of the other experiments, as I wished to employ all the materials at my disposal in discussing the Law of Fatigue. I now fully concur with Mr. Nipher's estimate of the value of his observations, made at varying rates, which he states "were merely published as a preliminary" (NATURE, vol. xi. p. 256, *note*).

The withdrawal of Mr. Nipher's experiments at varying rate from the controversy disposes at once of the greater part of the criticisms, which are based on the difference between his experiments at varying rate and at fixed rate.

Mr. Nipher, however, not only withdraws his experiments at varying rate, but criticises Dr. Macalister's and Mr. Gilbert Haughton's experiments of the same class.

I shall first answer his criticisms on the experiments of Dr. Macalister and Mr. Gilbert Haughton, and then notice his own new experiments at fixed rate and empirical formula.

The relation between n and t in Dr. Macalister's and Mr. Gilbert Haughton's experiments is represented by a central cubic, viz.:—

$$n = \frac{At}{1 + \beta t^2} \qquad (2)$$

This formula is plotted and compared with the experiments in Diagrams, pp. 472 to 474, and the agreement is evidently close. Mr. Nipher transforms equation (2) into the following:—

$$\frac{n}{t} = A - \beta\,(nt), \qquad (3)$$

and adds:—"Anyone who will take the trouble to calculate and co-ordinate the values of $\frac{n}{t}$ and nt from Prof. Haughton's ob-

* If we correct these values by the method of least squares, we find $A = 1033$, $\alpha = 1·094$, and may reduce the sum of the squares of the percentage differences from 316·33 to 242·56, thus making the agreement between theory and observation somewhat closer.

servations, pp. 468-474, will see that these co-ordinated values form a curve instead of a straight line."

I felt much surprise at reading this statement, because if the observations agree with the central cubic (2), they must agree with any transformation of equation (2).

I now give the values of $\frac{n}{t}$ and $n\,t$ and diagrams, comparing them with equation (3), an inspection of which will show that Mr. Nipher is in error in saying "that these co-ordinated values form a curve instead of a straight line." Anyone accustomed to such observations will see that they do *not* form a *curve*, but deviate *irregularly* as all observations do, above and below the "straight line," which is the true "curve" that represents them.

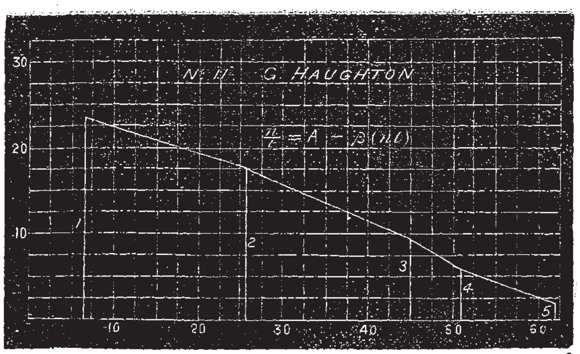
No. 1.—*Dr. Macalister's Experiments* ("*Animal Mechanics*," p. 468).

No.	$n\,t$	$\frac{n}{t}$
1	23·40	55·4
2	29·25	52·1
3	60·18	43·2
4	72·38	36·9
5	106·00	26·5
6	126·38	15·6
7	139·10	10·2
8	139·97	5·4

The accompanying diagram (No. 1) shows these values plotted, and the right line which represents them all except No. 8, which falls too much below the line.

No. 2.—*Mr. Gilbert Haughton's Experiments* (p. 474).

No.	$n\,t$	$\frac{n}{t}$
1	6·89	24·5
2	25·58	18·1
3	44·94	9·8
4	51·00	5·7
5	61·20	1·7



The accompanying diagram (No. 2) shows that these observations also may fairly be represented by a straight line.

Trinity College, Dublin, March 13 SAMUEL HAUGHTON

(*To be continued.*)

The "Wolf" in the Violoncello

As the question asked by Mr. Fryer in your issue of the 25th of March (p. 406) remains unanswered, allow me to suggest what has been brought prominently before me in some recent experiments.

The "wolf" of which he speaks occurs in all instruments of the violin family, and not only in the violoncello; indeed, it is present even in fine specimens by the great masters. It is perfectly true that it depends on the resonant case of the instrument itself, as can easily be shown in the way he suggests; a "false string" is soon detected and remedied by any player. No doubt it indicates that the consonating box has the power of reinforcing certain vibrations, but not others; and even of stifling some by interference. Curious facts on this topic have recently been brought before a foreign scientific society, which show that the acquired power of consonance depends on a molecular change in the material of which the instrument is made, that it can be increased by steady and good playing, that it is to be detected even in brass instruments like the trumpet. It has long been known that a violin deteriorates in the hands of a bad performer. But there is an obvious cause of weakness in all fiddles which seems to me to have hardly attracted sufficient attention; I mean the two "sound-holes" in the belly. These *f*-shaped apertures, which are doubtless needful to allow escape of aërial vibrations, cut the grain of the wood completely across in a most important part. Every connoisseur pays particular attention to the straightness and regularity of grain; indeed, blocks of wood well matched in this respect, from which two similar sides might be cut, have been handed down in workshops as of inestimable value. Wheatstone's well-known experiment of the Telephonic Concert proves how perfectly musical tones can be conveyed along the fibres of pine-wood to a considerable distance. These considerations led me recently to submit the point to the test of trial. What I have elsewhere termed "elliptical tension bars" are simply four longitudinal struts of light pine glued to the back of the belly, intercepting the sound-holes. They have the effect of removing the "wolf;" sometimes entirely, nearly always to a marked extent. No doubt they also act by strengthening the fabric exactly in the line in which the string pulls. The pull, which is considerable even in a state of rest, increases enormously when it is moved slightly out of its position of quiescence, for well-known mechanical reasons; and hence, besides the removal of the "wolf," there is gained by means of the bars a decided increase of power and tone.

The "elliptical" form was adopted because it is found to give considerable resistance with small amounts of material. Anything which rendered the belly of the fiddle heavy would perform the function of the "mute" as now commonly applied to the bridge, but which can be, and often is, replaced by a penny or a half-crown wedged between the strings below the said bridge. The great rigidity and low specific gravity of dry pine-wood meet the two requirements: the whole mass added does not exceed twenty or thirty grains.

Musicians are slow to adopt theoretical improvements, and dealers in violins cannot be expected to favour anything which puts a one and-ninepenny fiddle more nearly on a level with a Straduarius than it was; but I am honestly of opinion that the system is of value. I must, however, protest against its being prejudiced by the unsuccess of imitators or of previous efforts. Something of the sort has often been tried before, and it was only after long and laborious experiment that this particular attempt gave good results. By these, and in due time, I am content to let it be judged.

W. H. STONE

14, Dean's Yard

Flowering of the Hazel

THE question whether the male and female flowers of the hazel mature simultaneously on the same bush has been already discussed in your columns (NATURE, vol. i. p. 583, vol. iii. pp. 347, 509). A repetition of the observations this spring has enabled me to confirm my previous statement that this is the case, at all events very frequently; in fact, almost invariably in all the cases that have come under my notice. As this is in direct opposition to the statements of several of your correspondents, especially one resident in Kentucky, who affirms that the hazel, though apparently monœcious, is practically diœcious, it would be interesting if we had further information as to the circumstances under which these varying conditions occur. On the present occasion the male and female flowers were found in close contiguity and both in a mature condition at the close of a remarkably protracted cold and dry season, at an unusually late period, the last week in March. ALFRED W. BENNETT

A Flint Celt

ON Tuesday last, the 6th inst., I found on the west shore of this bay a very fine specimen of a flint celt, quite perfect. The cliff in the immediate vicinity is composed of fluviatile clays, capped with a thin bed of Bembridge limestone, in a very broken state: the vegetable soil resting on the latter is only from five to ten inches deep. Perhaps it may interest some of your readers if you do me the favour to notice this. It is rather remarkable